

FY 2012 Center for Advanced Energy Studies (CAES) Annual Report

November 2012



The INL is a U.S. Department of Energy National Laboratory
operated by Battelle Energy Alliance

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**Idaho National Laboratory
Idaho Falls, Idaho 83415**

<http://www.inl.gov>

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ANNUAL REPORT

2012



“Collaboration really is at the heart of the center’s success.”

Dear colleagues,

Fiscal year 2012 marked the seventh year of the Center for Advanced Energy Studies (CAES), a partnership between Idaho National Laboratory (INL) and Idaho’s three public research universities – Boise State University (BSU), Idaho State University (ISU) and University of Idaho (UI).

Once again, we made significant progress toward fulfilling our dual missions of building a collaborative research portfolio while educating the next generation of scientists and engineers to benefit Idaho, the region and the nation.

The CAES partners have proven that a national laboratory can work collaboratively with universities and achieve results. CAES is now touted as a model across the U.S. Department of Energy (DOE) complex.

Researchers from partner institutions are working side by side to assemble strong, innovative proposals that win funding from a variety of agencies and industries. And our virtual CAES model through which we pool resources and share equipment has allowed us to compete with much larger universities and win research dollars.

In addition, the university partners continue to build strong academic programs that are educating a new generation of scientists and engineers. BSU recently introduced a doctoral program in materials science and engineering and UI and ISU continue to build enrollment in nuclear-related fields.

The CAES partnership is flourishing because of the strong support of all involved.

Battelle Energy Alliance, the contractor that runs INL for the DOE, continues to invest more than \$5 million in the partnership. During the 2012 legislative session, the state of Idaho increased its funding for CAES to \$2 million.

The state also created the Idaho Global Entrepreneurial Mission (IGEM), a new program modeled after CAES. IGEM will funnel another \$2 million in research to the Idaho universities.

As the partnership enters its eighth year, we are taking steps to ensure the partnership succeeds well into the future.

Sincerely,
CAES Board of Directors

<i>David Hill, Deputy Lab Director for Science and Technology, Idaho National Laboratory</i>	<i>Richard Jacobsen, Executive Director for Research and Technology Transfer, Idaho State University</i>	<i>Jack McIver, Vice President for Research, University of Idaho</i>	<i>Mark Rudin, Vice President for Research and Economic Development, Boise State University</i>
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FY 2012 | By the Numbers

CAES provided the state of Idaho, DOE and Battelle Energy Alliance a strong return on investment in federal FY 2012.

COMPETITIVE RESEARCH AND OTHER FUNDING CAES RESEARCHERS WON IN FY 2012.

9.07
\$ MILLION

While much of \$9.07 million came from DOE programs – traditional sources of funding – CAES also diversified its portfolio. Researchers won grants from the National Science Foundation and the U.S. Department of Agriculture – firsts for CAES – and funding from industrial partners like the Innovation Center for U.S. Dairy.

TOTAL AMOUNT OF COMPETITIVE RESEARCH AND OTHER FUNDING CAES RESEARCHERS HAVE WON SINCE FY 2008.

50.97
\$ MILLION

THE STATE OF IDAHO'S INVESTMENT IN CAES DURING STATE FY 2012.

ONE.SIX
\$ MILLION

REGIONAL SALES CAES GENERATED IN FY 2012 ACCORDING TO AN ASSESSMENT BY A UI ECONOMIST.

13.98
\$ MILLION

THE STATE'S RETURN ON ITS FY 2012 INVESTMENT IN THE CAES PARTNERSHIP.

5.6:1

NUMBER OF JOBS CAES GENERATED IN FY 2012 ACCORDING TO A UI ASSESSMENT.

186 **1,075**

NUMBER OF JOBS CAES HAS GENERATED FROM (FY 2009–2012).

INDIRECT TAX REVENUE CAES GENERATED IN FY 2012

THREE HUNDRED TWENTY SIX THOUSAND AND TWENTY THREE DOLLARS

NUMBER OF STUDENTS ENROLLED IN NUCLEAR-RELATED DEGREE AND CERTIFICATE PROGRAMS AT THE CAES PARTNER UNIVERSITIES

583

This is nearly a 140% increase over 2010 enrollment in similar programs.

NUMBER OF PUBLICATIONS, PRESENTATIONS AND PROCEEDINGS CAES RESEARCHERS PRODUCED IN FY 2012.

225



Research Capabilities

CAES continues to build its research portfolio and strengthen partnerships through two major capabilities– the Microscopy and Characterization Suite (MaCS) and a computer-assisted virtual environment (CAVE).

CAES operates both of these laboratories as user facilities so scientists, engineers and others outside the partnership can gain access to them. Use of the CAVE and MaCS by internal and external researchers and partners grew substantially in FY 2012.

RESEARCHERS FROM THE CAES
PARTNER INSTITUTIONS, UNIVERSITY
OF WYOMING AND OTHER COLLEGES
ARE USING THE CAVE TO EXAMINE AND
EXPLORE DATA.



THE WESTERN ENERGY POLICY RESEARCH CONFERENCE CONTINUED TO GROW IN 2012. THE 2012 CONFERENCE FEATURED 45 PRESENTATIONS, A 35 PERCENT INCREASE FROM 2011.



MaCS users are from: Micron, Nanosteel, University of California–Santa Barbara, University of California–Berkeley, General Electric, Oxford University (United Kingdom), University of Florida, Texas A&M, Center for Space Nuclear Research, University of Wisconsin-Madison, INL and the Idaho universities.

CAVE users included several companies: Idaho Falls Power, the Idaho Cleanup Project, the Bonneville Power Administration, CRSA Architects and HDR Engineering.

Research Accomplishments

Exchanging research ideas

More than 80 people from industry, academia and government agencies converged in Boise to take part in the second annual Idaho Research Symposium. Launched by CAES in 2011, the symposium connects Idaho industry and companies with the state's researchers and spark potential collaborations. Twelve entities sponsored the event in FY 2012 and 58 companies participated, up from 22 companies the year before.

Discussing energy policy

The second annual Western Energy Policy Research Conference featured more than 45 presentations from 33 universities, national laboratories, and stakeholder groups throughout the United States, Canada and the United Kingdom. Sponsored by the CAES Energy Policy Institute, the conference is one of the few in the country that focuses on energy-related policy research.

Siting solar energy facilities

The CAES Energy Policy Institute leads a team of 12 researchers that is developing a computer-based Geographic Information System (GIS) tool to identify potential sites for large-scale solar energy facilities. The tool analyzes natural resource, physical characteristics as well as public acceptance/opinion of where such farms should be located. The \$2.8 million project is being funded through the DOE's Sunshot Initiative.

Researching nuclear energy

Researchers with the CAES nuclear science and engineering initiative won more than \$2.5 million from the DOE. The researchers, all from UI, won three of the 49 research projects funded by DOE's Nuclear Energy University Programs (NEUP) in FY 2012. Supathorn Phongikaroon, Akira Tokuhiro and Vivek Utgikar lead the various research projects (Utgikar and Milos Manic, a UI/CAES researcher also serve as collaborators on one).

\$109,524

POTENTIAL COST SAVINGS FROM ENERGY EFFICIENCY IMPROVEMENTS IDENTIFIED BY CEERI STUDENT TEAMS.

DR. DARRYL BUTT, A BOISE STATE UNIVERSITY PROFESSOR WHO LEADS THE CAES ADVANCED MATERIALS INITIATIVE, IS PART OF A NATIONAL TEAM RESEARCHING USED NUCLEAR FUEL STORAGE.

Improving energy efficiency

The CAES Energy Efficiency Research Institute (CEERI) launched a statewide industrial assessment center after receiving a DOE grant. Student teams at the CAES partner universities conducted free energy efficiency assessments for regional companies and manufacturing plants. The teams conducted eight visits and submitted four reports during FY 2012. Total projected energy savings identified by the teams is 1,003,464 kilowatt hours, 83,022 therms, 1,255 kilowatts and a potential cost savings of \$109,524.

Manure to fuel

A CAES bioenergy research team won a \$680,000 grant from the U.S. Department of Agriculture to investigate turning effluent, a liquid waste produced during the anaerobic digestion of dairy manure, to grow algae, which can then be used for several value-added products. The project is a collaboration between CAES and the Innovation Center for U.S. Dairy, an industry group that is committed to reducing greenhouse gas emissions at the nation's dairy farms by 20 percent.

Testing for geothermal

A CAES research team is working to improve the accuracy of geothermal reservoir temperature predictions, which could help lower geothermal exploration costs. The geofluids energy science team won a \$1 million grant from DOE to conduct the research.

Building sensors to monitor used fuel

Researchers from BSU/CAES, Darryl Butt, Sin Ming Loo and Mike Hurley are part of a multi-university team investigating whether or not used nuclear fuel can be stored safely in giant, stainless steel casks for 100 years or more. BSU's portion is to develop a sensor array that detects any changes to the used fuel or cask from the inside out.



MILOS MANIC, A UNIVERSITY OF IDAHO
PROFESSOR AND CAES RESEARCHER,
WON A \$275,000 GRANT TO CREATE A
REVERSE 911 SYSTEM THAT USES THE
INTERNET – NOT TELEPHONE LINES –
TO ISSUE ALERTS.

**DID YOU
KNOW?**

CAES/UNIVERSITY RESEARCHERS WON THREE NATIONAL SCIENCE
FOUNDATION GRANTS IN FY 2012, A MAJOR ACCOMPLISHMENT
BECAUSE NSF FUNDING IS EXTREMELY COMPETITIVE.



Photo courtesy of the Post Register

Educating the Energy Workforce

Student opportunities

CAES provides students opportunities to work in cutting-edge laboratories and on a variety of projects, from separating used nuclear fuel to researching new applications of nuclear energy in space. More than 50 students interned or conducted graduate-level research at CAES during FY 2012.

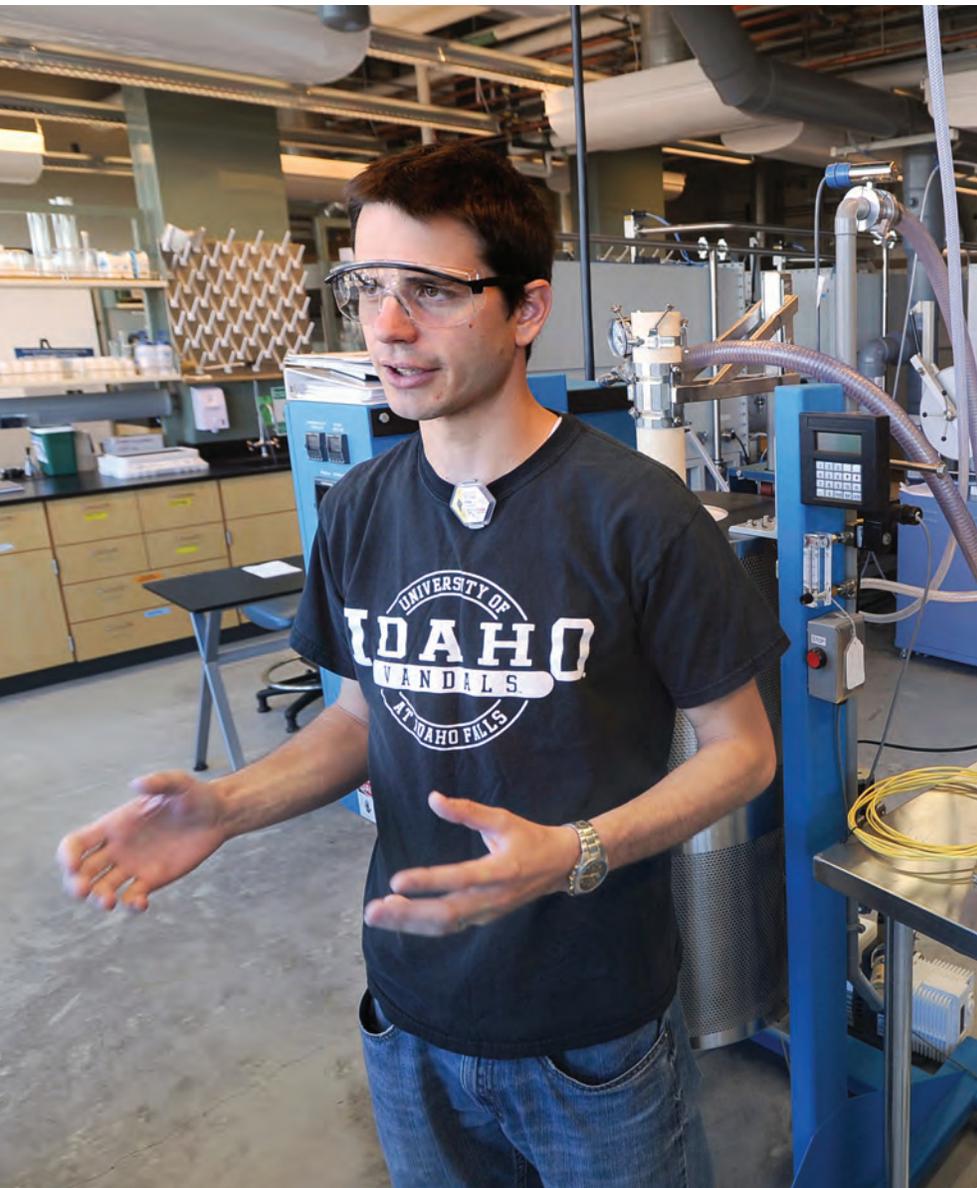


Photo courtesy of the Post Register

“I enjoy working at CAES because it allows me an opportunity to participate in cutting-edge research projects as well as providing an environment for international and domestic collaboration with scientists, engineers, and students.”
-Ammon Williams, graduate student, nuclear engineering, UI

AMMON WILLIAMS, A UI GRADUATE STUDENT, WORKS WITH DR. SUPATHORN PHONGIKAROON ON SEPARATING USED NUCLEAR FUEL THROUGH PYROPROCESSING.

STUDENTS ENROLLED IN THE NUCLEAR

OPERATIONS TECHNICIAN PROGRAM

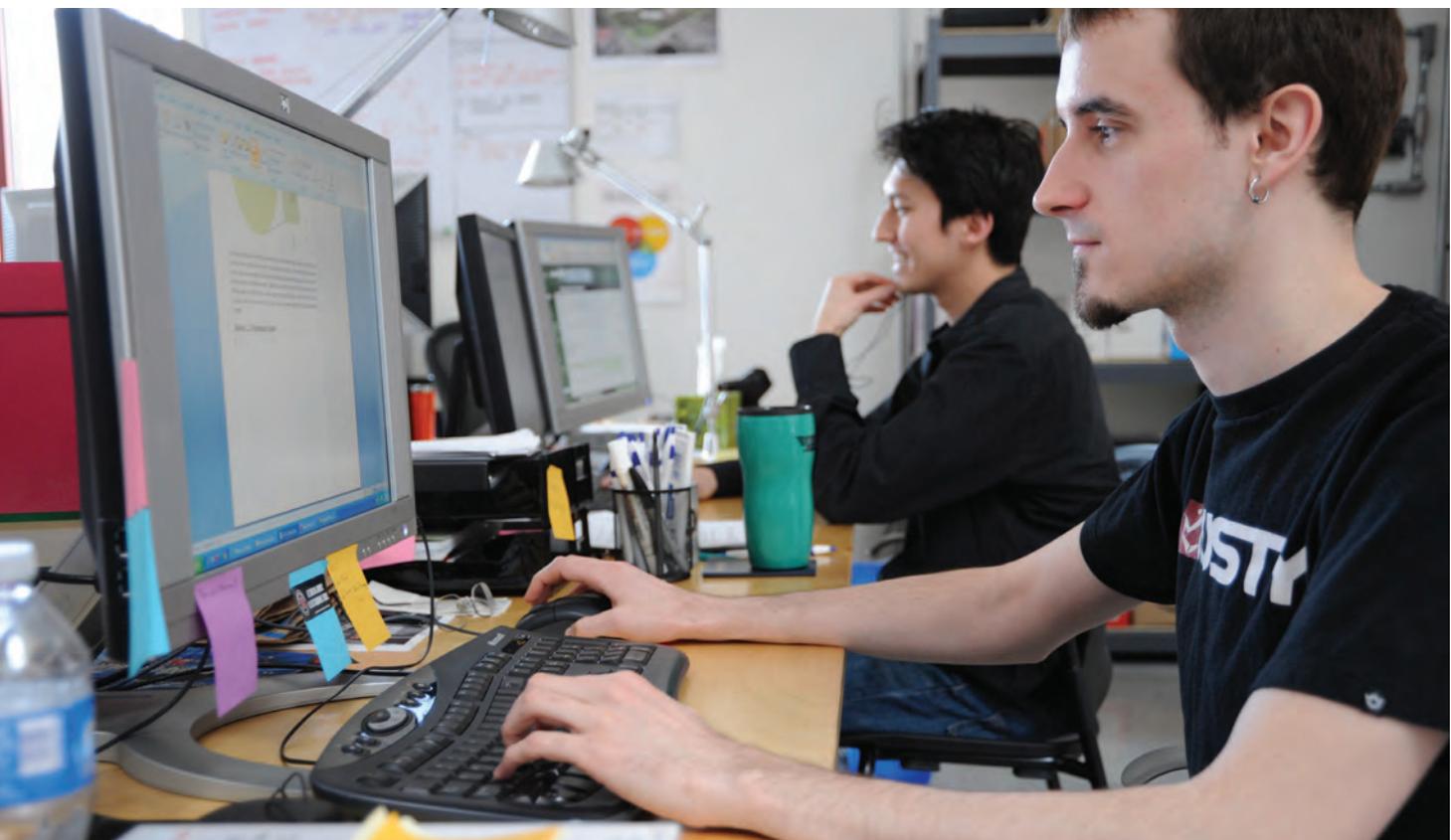
AT ISU'S ENERGY SYSTEMS TECHNOLOGY

AND EDUCATION CENTER (ESTEC)

INTERMED AT INL DURING FY 2012.

Funding scholarships

CAES awarded \$2,250 in scholarships to three INL interns interested in energy careers. Winners were: Kenneth Peters, a geography student at UI; Callan McGriff, a civil engineering major at UI; and Dane Sterbenz, a nuclear engineering major at ISU. CAES launched the program 5 years ago to help fulfill its mission of increasing the number of students entering the energy field.



DID YOU KNOW?

CAES INVESTED \$1.4 MILLION IN INL-FUNDED SEED MONEY TO RESEARCHERS FOR EXPLORATORY PROJECTS IN FY 2012. PROJECTS INCLUDED: IMPROVING DRIVER BEHAVIOR AND FUEL EFFICIENCY OF THE INL BUS FLEET, RESEARCHING AND IMPROVING A TWO-STAGE ANAEROBIC DIGESTION PROCESS, AND DESIGNING BETTER ALARM SYSTEMS FOR POWER PLANT CONTROL ROOMS.

Supporting STEM education

More than 400 educators attended four hands-on workshops sponsored by the Idaho Science, Technology, Engineering and Mathematics initiative – or i-STEM – of which CAES is a member. CAES also provided tours to several student groups during FY 2012, including Idaho Science and Aerospace Scholars and My Amazing Future, a female-oriented, hands-on STEM workshop.

CAES AND ITS PARTNER INSTITUTIONS SUPPORT SEVERAL STEM EVENTS THROUGHOUT THE YEAR, INCLUDING HANDS-ON ACTIVITIES FOR K-12 STUDENTS.



\$44,250
1,000-plus
3,000+

AMOUNT OF SCHOLARSHIP MONEY CAES HAS DISTRIBUTED SINCE FY 2009.

NUMBER OF IDAHO K-12 EDUCATORS WHO HAVE ATTENDED I-STEM TEACHER INSTITUTES SINCE 2009.

NUMBER OF PEOPLE WHO TOURED CAES AND VISITED THE CENTER'S COMPUTER-ASSISTED VIRTUAL ENVIRONMENT (CAVE) IN FY 2012.

Awards and Accomplishments

Idaho university students win geothermal competition

A student team from ISU took first place and a BSU team placed second in DOE's National Geothermal Student Competition. All three Idaho public research universities – BSU, ISU and UI – had teams in the finals. The subject of this year's competition was the geothermal potential of Idaho's Snake River Plain.

Researcher recognized by international organization

An international organization honored UI/CAES researcher Milos Manic for his work in computational intelligence and industrial electronics. The Industrial Electronics Society, a division of the Institute of Electrical & Electronics Engineers, selected Manic to receive its first David Irwin Early Career Award. The award is given to a "young researcher who has made significant contributions to the advancement of the field of industrial electronics."

UI students win poster competition

Graduate students from UI, Ammon Williams and Robert Hoover, placed first and third at the 2012 American Nuclear Society Student Conference's poster competition. Williams and Hoover, both of whom are based at CAES, work with Dr. Supathorn Phongikaroon, a UI researcher in Idaho Falls. Williams and Hoover competed against students from universities across the country.

DID YOU KNOW?

CAES HELPS PAY THE SALARY OF EIGHT RESEARCHERS/PROFESSORS AT THE IDAHO UNIVERSITIES THROUGH INL'S JOINT APPOINTMENT PROGRAM, WHICH IS DESIGNED TO PROMOTE COLLABORATION BETWEEN THE LAB AND ACADEMIA.

MORE THAN 50 STUDENTS INTERNEDED
OR CONDUCTED GRADUATE LEVEL-
RESEARCH AT CAES DURING FY 2012.

Nuclear energy scholarships

Students from UI and ISU won more than \$300,000 in fellowships and scholarships from DOE's Nuclear Energy University Programs (NEUP). Richard Skifton, a UI student based at CAES, and Brycen Wendt of ISU received three-year, \$155,000 fellowships to pursue graduate degrees and Jason Stock, an ISU student, was awarded a \$5,000 undergraduate scholarship.



ISU/CAES associate director honored

A national organization awarded Jason Harris, an ISU professor and CAES Associate Director, for his work in the field of health physics. The Health Physics Society presented Harris with its Elda E. Anderson Award, which is given to a young member and recognizes excellence in research or development, discovery or invention, devotion to health physics and significant contributions to the field.



DR. JASON HARRIS, AN ISU PROFESSOR WHO LEADS THE CAES NUCLEAR SCIENCE AND ENGINEERING INITIATIVE, WAS HONORED BY THE HEALTH PHYSICS SOCIETY FOR HIS WORK IN THAT FIELD.

Three named outstanding CAES contributors

CAES honored employees from its partner institutions for their contributions to the partnership and its mission. Kevin Feris of BSU, Kristi Moser-McIntire of ISU and Dennis Keiser of UI were named outstanding CAES contributors for 2012. This is the third year CAES has given out the awards.

International organization recognizes UI/CAES researcher

Dr. Donald M. McEligot, a distinguished visiting professor in mechanical engineering at UI and a CAES scientist, received the International Network of Engineering Education and Research (iNEER)'s Leadership Award. The organization selected McEligot was for his "visionary leadership in innovative research, consistent scholarship through international collaborations and pioneering contributions to engineering."

ELLEN RABENBURG, A BSU GRADUATE
STUDENT, WORKS IN THE CAES
MATERIALS LAB.

RIGHT - AN ISU EMPLOYEE WORKS WITH
THE SCHOOL'S RESEARCH REACTOR.

THREE

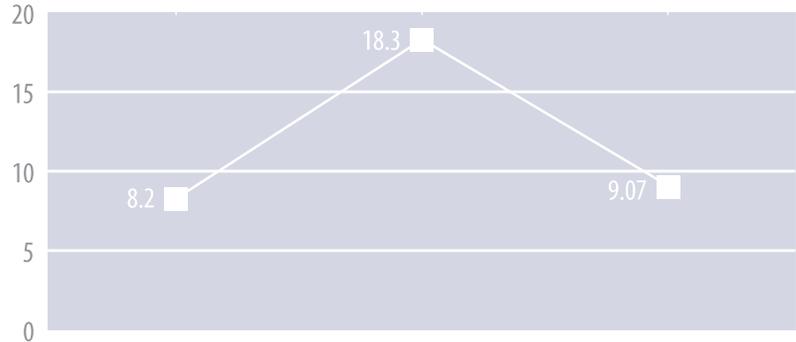
NUMBER OF EMPLOYEES NAMED AS OUTSTANDING
CAES CONTRIBUTORS



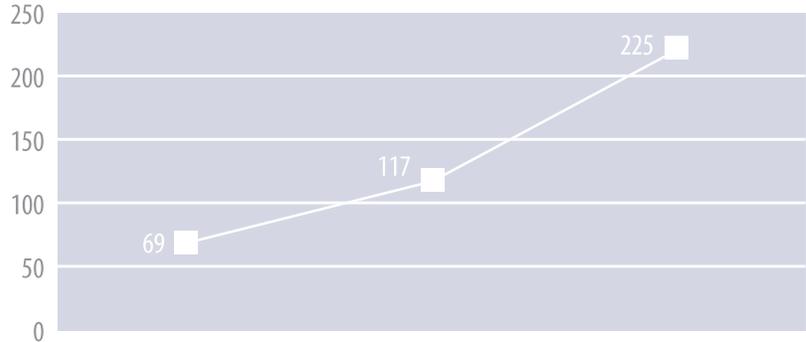
THE GRAPHS DEPICT CAES' PERFORMANCE OVER THE PAST THREE YEARS.

**DENOTES CHANGE IN REPORTING FROM A STATE FISCAL YEAR TO A FEDERAL FISCAL YEAR.*

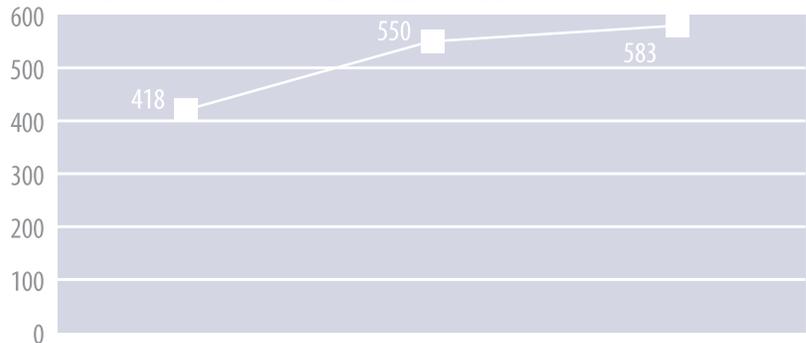
RESEARCH AND OTHER FUNDING (\$ MILLION)



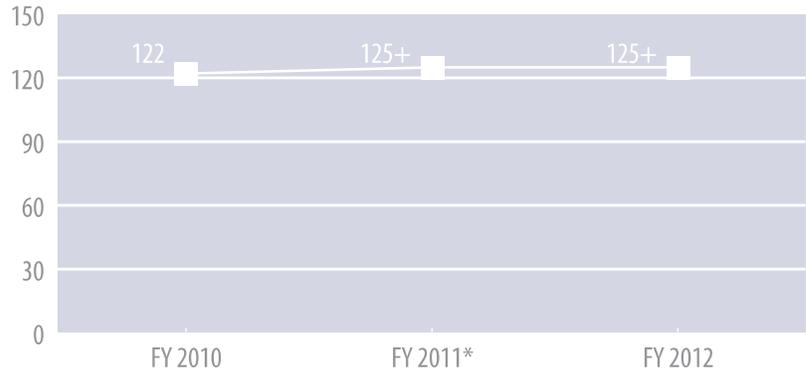
PUBLICATIONS, PAPERS AND PRESENTATIONS



NUMBER OF STUDENTS IN NUCLEAR-RELATED FIELDS



CAES AFFILIATE RESEARCHERS





CAES ADDS CAPABILITIES AND EQUIPMENT THAT SUPPORTS RESEARCH AND PROVIDE A COMPETITIVE EDGE. THE IDAHO FALLS FACILITY IS HOME TO UNIQUE EQUIPMENT, INCLUDING A SPARK PLASMA SINTERING SYSTEM CONTAINED WITHIN A GLOVEBOX AND A HIGH-END MICROSCOPY LAB.





RESEARCH AT CAES FOCUSES ON NUCLEAR SCIENCE AND ENGINEERING, ADVANCED MATERIALS, BIOENERGY, CARBON MANAGEMENT/GEOTHERMAL ENERGY, ENERGY EFFICIENCY, ENERGY POLICY, AND MODELING AND SIMULATION.

RIGHT: UI'S INTEGRATED DESIGN LAB, WHICH IS BASED IN BOISE, PLAYS A MAJOR ROLE IN THE CAES ENERGY EFFICIENCY RESEARCH INITIATIVE (CEERI).



ABOVE: BIG SKY WEST DAIRY IN GOODING, IDAHO RECEIVED A CAES/INL ENERGY ACHIEVEMENT AWARD FOR ITS COMMITMENT TO CONVERTING MANURE INTO POWER AND OTHER USEFUL PRODUCTS.





CAES STUDENTS HAIL FROM ALL OVER
THE WORLD - CHINA, NIGERIA, INDIA,
SRI LANKA, KOREA, AND THE CZECH
REPUBLIC AND OTHER COUNTRIES.

12 DOZEN

NUMBER OF DUMPLINGS MADE AND SERVED
DURING A CHINESE NEW YEAR CELEBRATION
AT CAES.

Publications, Presentations, and Proceedings

- Acharya, S., M.F. Hurley, and D.P. Butt, 2012, "Versatile In-Situ Engine Lubricant Health Sensor," Presented at the 9th Annual Boise State University Undergraduate Research Conference, Boise, ID, April 16, 2012.
- Aldrich, E., C. Koerner, and D. Solan, 2011, "Analysis of Liability Regimes for Carbon Capture and Sequestration: A Review for Policymakers," Energy Policy Institute, December 2011.
- Aldrich, E.L., and C. Koerner, 2011, "Assessment of Carbon Capture and Sequestration Liability Regimes," The Electricity Journal, 24 (7), pp. 35–48.
- Aldrich, E.L., C. Koerner, J. C. Perkowski, and T. McLing, 2012, "Managing the Risks of Carbon Sequestration: Liability Concerns and Alternatives," J.A.F. Stoner and C. Wankel (Eds.), Managing Climate Change Business Risks and Consequences: Leadership for Global Sustainability, New York City, NY: Palgrave Macmillan, March 2012.
- Aldrich, E.L., and C. Koerner, 2012, "Unveiling Assigned Amount Unit (AAU) Trades: Current Market Impacts and Prospects for the Future," Atmosphere, 3 (1), pp. 229–245.
- Allahar, K., J. Burns, B.J. Jaques, I. Charit, D.P. Butt, and J. Cole, 2012, "Consolidation of Ferritic Oxide Dispersion Strengthened Alloys by Spark Plasma Sintering," Presented at the 141st Annual TMS 2012 Conference, Orlando, FL, March 11–15, 2012.
- Allahar, K.N., J. Burns, B.J. Jaques, Y.Q. Wu, I. Charit, D.P. Butt, and J. Cole, 2012, "Consolidation of Ferritic Oxide Dispersion Strengthened Alloys by Spark Plasma Sintering," Presented at the Processing and Properties of Powder-Based Materials, 2012 TMS Conference, Orlando, FL, March 11–15, 2012.
- Allahar, K., M. Hurley, and E. Sapper, 2012, "Influence of Electrode Surface Condition on Constant Phase Element Characterization," Presented at the 221st Meeting of the Electrochemical Society, Boston, MA, October 2011.
- Allahar, K. N., M.F. Hurley, and D.P. Butt, 2012, "Interpretation of the Relaxation Potential Profile of an AC-DC-AC Test," Presented at Materials Science and Technology Conference 2012, Pittsburgh, PA, October 2012.
- Allahar, K. N., M.F. Hurley, and D.P. Butt, 2012, "Modeling the Relaxation Potential Profile of an AC-DC-AC Test," Presented at the NACE 2012 Conference, Salt Lake City, UT, March 2012.
- Allahar, K.N., M. Hurley, and E. Sapper, 2012, "Modeling the Relaxation Potential During an AC-DC-AC Test," Presented at the Research in Progress Symposium, NACE Corrosion 2012, Salt Lake City, UT, March 2012.
- ANS Café Blog., 2012, <http://ansnuclearcafe.org/2011/10/28/radiation-and-reason-a-private-trip-to-tokyo-and-fukushima/dr-akira-tokuhiro/>, Accessed October 2012.
- Artrip, K., D. Shrestha, and D. Keiser, 2011, "Reducing Greenhouse Gas Emissions on Idaho Dairy Farms through the Use of Anaerobic Digestion Systems," Poster presentation at the Bioenergy Research Collaboration Symposium, University of Idaho, Moscow, ID, 2011.
- Barkouki T.H., B.C. Martinez, B.M. Mortensen, T.S. Weathers, J.D. De Jong, T.R. Ginn, N.F. Spycher, R.W. Smith, and Y. Fujita, 2011, "Forward and Inverse Bio-Geochemical Modeling of Microbially Induced Calcite Precipitation in Half-Meter Column Experiments," Transport in Porous Media, 90: 23-39, doi: 10.1007/s11242-011-9804-z.
- Beazer, R., D.P. Ames, J. Joe, D. Solan, D. Koehler, and J. Carlisle, 2011, "Integrating Social Attitudes and GIS The LineSiter Application," Presented orally at engineering seminar for Idaho State University in Idaho Falls, ID, November 2011.
- Beazer, R., D.P. Ames, J. Joe, D. Solan, D. Koehler, and J. Carlisle, 2011, "Integrating Social Attitudes and Spatial Data in Siting Power Lines Using the DotSpatial Framework: Introducing the LineSiter Application." Poster presentation, Free and Open Source Software for Geospatial (FOSS4G) Conference, Denver, CO September 2011.
- Beazer, R., D.P. Ames, J. Joe, D. Solan, D. Koehler, and J. Carlisle, 2011, "Stream Flow and Least Cost Path Analysis: An Algorithmic Comparison," Presented orally at engineering seminar for Idaho State University in Idaho Falls, ID, November 2011.
- Becker, S., D.M. McEligot, E.J. Walsh, and E. Laurien, 2011, "Criteria for Boundary Layer Transition," ASME paper GT2011-45110, International Gas Turbine Conf., Vancouver.
- Becker, S., D.M. McEligot, E.J. Walsh and E. Laurien, 2012, "Entropy Generation in a Flow Transitioning Downstream of a Rib," Turbulence, Heat and Mass Transfer 7, Eds.: K. Hanjalic, Y. Nagano and S. Jakirlic, New York: Begell House, in press.
- Benjankar, R., G. Egger, K. Jorde, P. Goodwin, and N. Glenn, 2011, "Dynamic Floodplain Vegetation Model Development for the Kootenai River," Journal of Environmental Management, 92, pp. 3058–3070.
- Benjankar, R., K. Jorde, E. Yager, G. Egger, P. Goodwin, and N. Glenn, 2012, "The Impact of River Modification and Dam Operation on Floodplain Vegetation Succession Trends in the Kootenai River," Ecological Engineering, 46, pp. 88–97.
- Black, G., 2012, "Economic and Employment Impacts of Small Modular Nuclear Reactors," Invited presentation at the Leadership in Nuclear Energy Commission, Boise, ID, June 2012.
- Black, G., 2012, "Estimating the Economic Impacts of Small Modular Reactors," Presented at the Platts 3rd Annual Small Modular Reactor Conference, Arlington, VA, May 21, 2012.
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- Borowik, G., T. Luba, and D. Zydek, 2011, "Reduction of Knowledge Representation Using Logic Minimization Techniques," Proc. of 21st International Conference on Systems Engineering (ICSEng 2011), IEEE Computer Society Press, pp. 482–485.
- Carlisle, J., and M. Bowman, 2012, "The Role of Public Awareness and Understanding in Solar Energy Siting Projects," Paper presented at the 2012 Western Energy Policy Research Conference, Boise, ID, August 2012.
- Carlson, A.H., R.E. Hiromoto, and R.B. Wells, 2011, "Breaking Block and Product Ciphers Applied Across byte Boundaries," IEEE Conference IDAACS 2011, Prague, Czech Republic, September 15–17, 2011.
- Chakraborty, M., C. Miao, A. McDonald, and S. Chen, 2012, "Concomitant Extraction of Bio-oil and Value Added Polysaccharides from Chlorella Sorokiniana Using a Unique Sequential Hydrothermal Extraction Technology," Fuel, 95:63-70.

NUMBER OF PUBLICATIONS,
PRESENTATIONS AND PROCEEDINGS CAES
RESEARCHERS PRODUCED IN FY 2012

225

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36. Cumberland, R., R. Hoover, S. Phongikaroon, et al., 2011, "Analysis of Equilibrium Methods for the Computational Model of the Mark-IV Electrorefiner," *Nuclear Engineering and Technology*, 43 (6), pp. 547–556, doi: 10.5516/NET.2011.43.6.547, December 2011.
37. Daniel, D., D. Thomsen, P. Price, P. Raghani, and D.P. Butt, 2011, "Preliminary Density Functional Studies on Lanthanum Ferrite Perovskite Ceramics," Poster presentation at the 2nd Annual Center for Advanced Energy Studies (CAES) Workshop on Modeling, Simulation and Visualization, Boise, ID, September 8–9, 2011.
38. Davis, R., R. Skifton, and A. Tokunohiro, 2012, "One Possible Pitfall with Current Practice in Grid-Convergence," *Bulletin APS*, 64th Annual APS Div. Fluid Dynamics, 56, 18, Baltimore, MD, November 20–22, 2011.
39. Day, J., J. Theodorson, and K. Van Den Wymelenberg, 2012, "Understanding Controls, Behaviors and Satisfaction in the Daylit Perimeter Office: A Daylight Design Case Study," *Journal of Interior Design*, 1, pp. 17–34.
40. Derr, K., and M. Manic, 2011, "Extended Virtual Spring Mesh (EVSM): The Distributed Self Organizing Mobile Ad Hoc Network for Area Exploration," *IEEE Trans. on Industrial Electronics*.
41. Djunaedy, E., K. Van Den Wymelenberg, and H. Thimmanna, 2011, "Rightsizing: Using Simulation Tools to Solve the Problem of Oversizing," *Building Simulation 2011 Annual Conference Proc.*, Sydney, Australia.
42. Duarte, C., B. Acker, R. Grosshans, M. Manic, K. Van Den Wymelenberg, and C. Rieger, 2011, "Prioritizing and Visualizing Energy Management and Control System Data to Provide Actionable Information for Building Operators," *Western Energy Policy Research Conference*, Boise, ID, August 25–26, 2011.
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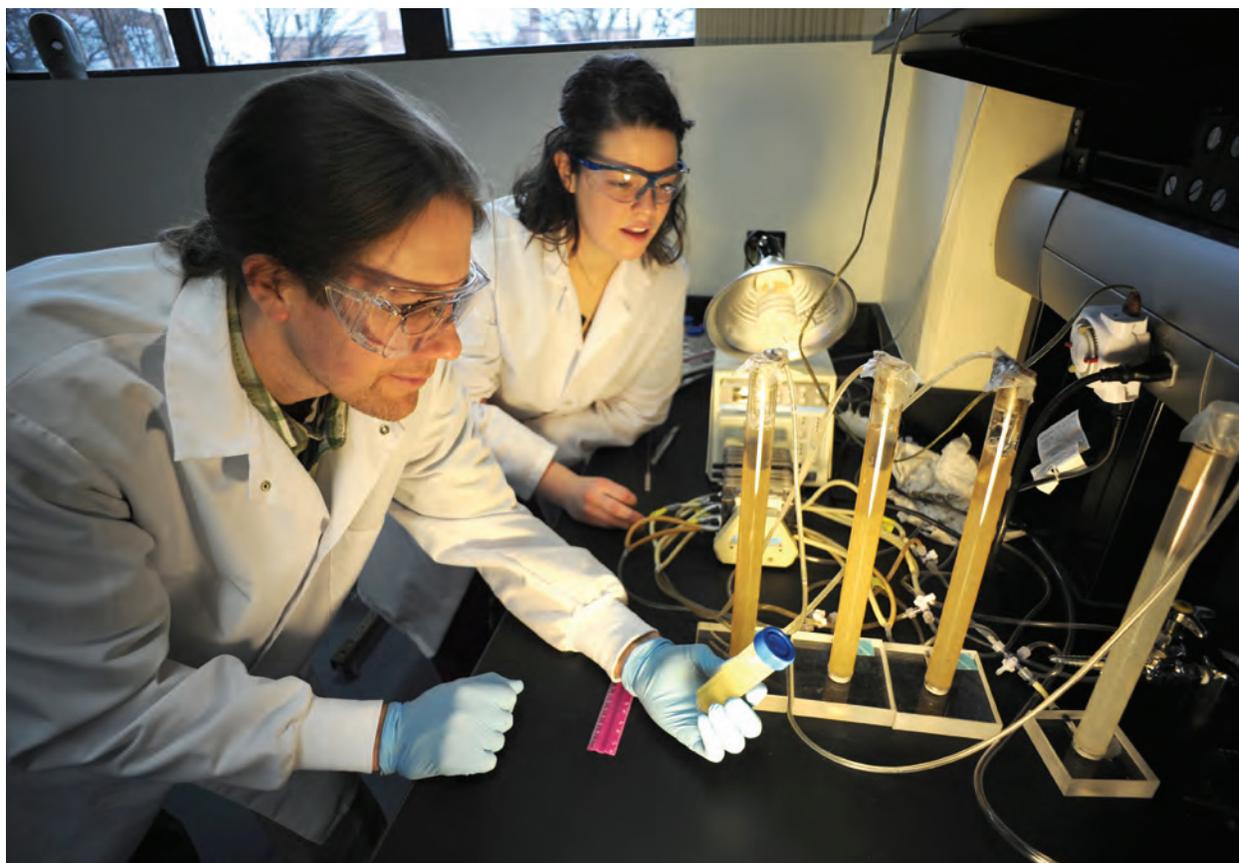
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